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[WITH THE COMPLIMENTS OF THE AUTHOR.]

# FRACTURE OF THE PATELLA

AND

TREATMENT BY A NEW METHOD.

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## FRACTURE OF THE PATELLA AND TREATMENT BY A NEW METHOD.<sup>1</sup>

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It may be accepted as a rule in medical or surgical practice, that the treatment of diseases or injuries, which have many remedies, is unsatisfactory. This pertains in no small degree to the treatment of fracture of the patella. There is no fracture to which a greater variety of apparatus has been applied, and yet the results attained are by no means satisfactory; bony union rarely occurs, and the affected limb is seldom as strong as before the injury.

It is well to remember that the patella resembles the sesamoid bones in its development in the tendon of the quadriceps extensor, that it consists of loose cancellous tissue covered by a thin, compact lamina, and that it is this kind of osseous structure, moderately supplied with nutrient vessels, which, when injured, undergoes slow and imperfect reparative processes. From the exposed position of the patella it is subject to accidents of great variety; yet the large majority of fractures are transverse, and are caused by the enormous muscular force exercised by the extensor group acting in a spasmodic way, usually to prevent the body from falling backward. When we reflect that the full power of these muscles is probably expended in a great variety of the ordinary avocations of life, it is worth while to inquire how the patella can be fractured by muscular effort. This I believe to occur only when the muscular tension is at an angle with the long axis of the bone, producing a leverage effect over the condyle of the femur, and this is precisely the position of the body, when an individual makes a sudden effort to save himself from falling backward. Soon after the injury there is usually developed a more or less severe synovitis, with effusion. This is a far more important factor in the injury and its results than is usually believed. It is generally supposed that the extensor group is in a state of contraction after the injury, and that, owing to this, the upper

<sup>1</sup> Read before the Suffolk District Medical Society, October 28, 1876.

fragment is carried away from its fellow a considerable distance. If I may judge from my own observations this is not generally true, and in the patient seen immediately after the injury, when the limb is placed at rest in a state of extension, the fragments adjust themselves nearly in apposition, and remain so until separated by the effused fluid.

We should remember that the patella is firmly attached by its entire circumference to strong fibrous structures; and, when the bone is broken, many of the fibres may escape injury, and are usually amply sufficient to retain the fractured portions in place — the limb being extended and at rest — so long as there is no distending force exerting pressure from within. Soon, however, fluid is effused, and though at first only a slight separation existed between them, the fragments are now removed a considerable distance from each other. Not only does fluid occupy the space between the fragments, but these are tilted upward at a considerable angle. There are rare cases where very little effusion occurs, and it is, as I believe, precisely these cases in which the fragments are little separated and the best results are obtained. I think I have seen one case of true bony union, and, as I remember it, although it was some years ago, and before I recognized the clinical importance of the effused fluid, there was little or no distension of the joint.

A good practical rule might be deduced, that the results will depend largely upon the amount and duration of the fluid. The farther apart the fragments are, the greater the difficulty of apposition, and if separated for any considerable period they cannot unite by bone.

Mr. William Adams has given us much valuable information in his careful study of the specimens of this fracture contained in the London museums. When the fragments are not separated more than an inch and a half, the interspace is usually filled by firm fibrous tissue. In some of these cases, however, and in those separated by a greater space, Mr. Adams finds that the fragments are not united by plastic matter, but are bound together by thickened fasciæ which pass over the patella and incorporate themselves with the bursa patellæ. This aponeurotic structure is arranged in different ways. It may be adherent to the periosteal surface of both fragments and pass between them; it may be reflected over, and may be adherent to both fractured surfaces; or, as most frequently happens, the connecting aponeurosis may pass from the periosteal surface of the upper fragment to the fractured surface of the lower one, to which it becomes firmly united. In the majority of cases, when thus united the fragments are tilted outward, being in closer



relationship upon the articular than upon the periosteal surface. Of thirty-one specimens examined, fifteen were thus united, twelve by ligamentous and four by undetermined union. Union as thus described leaves a very imperfect result. The limb is weak, the joint is unprotected, the fragments are so widely separated that the articular surfaces may be felt between them, and the fasciæ may be folded in or adherent to the capsule of the joint.

This brief review of the injury, and of the character of the inflammatory and reparative processes, brings us naturally to the consideration of its treatment. Much ingenuity has been expended in a great variety of appliances, as every surgeon is aware, from Sir Astley Cooper's bandage above and below and cross-ties between, and Malgaigne's hooks variously modified, and especially made practicable by Spence of Edinburgh, to the method of Eve of Tennessee, who surrounds the fragments with a ring. The fragments have even been cut down upon and wired, with bony union as a result; and as a believer in antiseptic surgery I trust it may not be too much to hope that the time will come when this may be adopted as the safest and best rule.

Professor Wood's method, modified by Hamilton, of a figure of eight bandage, the limb resting upon a wide inclined plane, is a favorite one in America, and I have used it in a number of cases with good results. It is open to two objections: first, it tilts the fragments forward and consequently places them in an unfavorable position for union; secondly, the constrained position is a very painful one to the patient. A large, fleshy woman, who had sustained fracture of both patellæ from muscular action, was treated by me two years ago by this apparatus. It was midsummer, and the suffering from this unnatural and constrained position alone was most cruel and severe.

Sanborn, of Lowell, has devised a very simple appliance which has given excellent results. It consists of a long piece of adhesive plaster extending from the thigh to the ankle, left in a loop over the knee; this is twisted by an inserted stick until the desired approximation is attained. Of course the limb remains at rest on a splint.

Mr. Teale, of Leeds, has treated a number of cases by the "expectant method" with success. He evidently recognizes the fact referred to earlier in this paper, that the muscles when at rest are not in a state of contraction, and gives the following reasons for the approximation of the fragments: "First, at the time of injury the quadriceps extensor is thrown into a state of tonic contraction. After a few days this con-

traction relaxes, and the muscle gradually regains its normal length, thus removing all traction on the broken bone. Second, the effusion, which always occurs at the time of the accident, is slowly absorbed, and by its removal allows the fragments to fall together. And third, the fibrinous band, which is formed between the opposing surfaces, has, like all cicatricial tissue, a tendency to contract, and thus to complete the approximation."

Much ingenuity has also been expended upon the construction of hospital appliances to bring, by means of weights and pulleys, the fragments into apposition, and good results have been obtained.

A careful study of the pathological processes brings one to the deduction of a few simple rules for treatment.

The first, and as I believe one of the most important factors of all, is the effusion. This, if in large quantity, or if not rapidly absorbed, from my experience in aspiration in acute synovitis of idiopathic character, I would unhesitatingly remove by the aspirator, and repeat the operation if necessary. The fracture cannot be treated in permanent apparatus until after the effusion has disappeared, but rest on pillows, cold applications locally, etc., answer very well. I have in several instances placed the limb in Hamilton's splint for the first week.

As soon as the traumatic inflammation has subsided, I have used in the last three cases the following, which so far as known to me is a new method of treatment.

Adhesive plaster of good quality, upon strong cloth (I have found that of Maw & Sons, of London, prepared upon thick cloth, the best), cut in pieces of concentric shape, of considerable width, should be carefully adjusted both above and below the patella. The inner edges are best turned slightly back upon themselves, or welted over a small cord, while the projecting points are doubled back for reinforcement as well as to prevent their adhesion to the skin. These pieces are perforated for the introduction of an elastic cord.

The limb is carefully enveloped in a plaster bandage extending from the toes to the hip, and strengthened by inlaid pieces of tin. The same precautions are required in the application of the bandage as in fracture of the thigh, to secure rest and support, as well as disablement of the muscles. The best proof of its proper application is that the limb is perfectly comfortable, and at the same time voluntary muscular contraction is reduced to the minimum.

Tins are incorporated into the bandage each side of the knee, of suit-



able shape to reinforce the fenestra, which is at once cut in the bandage, of oval shape and sufficiently large to liberate the entire patella, with a free surrounding of nearly an inch. Loops of wire (one or better two on each side, above and below the knee) are also adjusted in the bandage at suitable distances for the tying of the elastic ligatures fixed in the extremities of the adhesive plaster. The proper position of these loops is of some importance; for if placed too low, the pressure is too great from above downward, which results, as in the figure of eight bandage, in tilting forward of the fragments, thus causing the fractured surfaces to approach each other at a greater or less angle.

Pressure is made upon the fragments by the adjustment of the cords. Much less force is required than would be supposed, the lower piece of plaster fixing the lower fragment, while the upper draws its fellow into apposition. The inclosed surface over the patella is easily rendered cedematous by interference with the capillary circulation, if too much tension is used.

The patient may be at once allowed to walk with crutches, the foot being supported by a sling from the neck, as in fracture of the thigh. After the first week he may ride, and, in fact, attend to many light duties.

In illustration of this treatment I will briefly report my last three cases treated by this method.

CASE I. April 21, 1876. Mr. T. L., a strong, healthy man, in middle life, fractured the left patella transversely by muscular effort. The leg was kept at rest upon an inclined plane until the effusion, which was of considerable amount, subsided, and on April 27th was put up as above described.

The splint was removed at the end of seven weeks, and a light splint was adjusted for a few weeks longer. The patient was on crutches after the first few days, and busied himself most of the time correcting proof, as his business was that of a music printer. September 1st, he walked with only a slight halt, and chiefly complained that the limb became tired sooner than its fellow. The union is ligamentous, and does not exceed a quarter of an inch in length.

CASE II. April 28th. Mr. F. L., aged twenty-nine, fractured the right patella transversely by muscular action. The synovitis was severe and the effusion was very marked, and in consequence I was unable to apply a permanent apparatus until the thirteenth day. The fragments came well into apposition and were easily retained. In a few days the

patient walked with the aid of crutches, and enjoyed driving almost every pleasant day. The treatment in all respects was similar to that in the first case. September 1st the fragments were separated by about one third of an inch, and on the 25th by five eighths of an inch. The union now seems firm and the fragments freely movable, but the fractured edges are tilted forward at an angle, and the result is evidently modified and less successful on account of the great amount of effusion. In a similar case I would aspirate the fluid. The patient wears a knee-cap, and walks easily with the aid of a cane.

CASE III. Mrs. W., seen in consultation with Dr. Flowers, of Cambridge, fractured her right patella in April, six years ago, and was kept in bed nine weeks, the limb supported on a straight splint, and then had a plaster splint adjusted, which she continued to wear until the following January. The limb was almost entirely stiff for many months, yet the fragments were separated so that the finger could be laid between them. July 6, 1876, the ligamentous union was broken by a muscular effort to save herself from falling. There was a considerable amount of effusion and ecchymosis, which subsided in about ten days, when I applied the apparatus as above. She began to walk with crutches in a few days, and suffered very little during her treatment. The splint was removed in fifty days, a knee-cap was applied, and the patient now walks with the aid of a cane. The fragments are separated one fourth of an inch. The knee can be slightly flexed.

New devices are likely to be overestimated. I would not claim too much for the above method. It has the advantage of being simple, keeps the injured parts open to inspection, saves the patient the irksome suffering of weeks in a constrained position, and maintains his general health by exercise and ability to be out of doors, which last is no minor factor in hastening the reparative processes. In the hands of any physician of moderate mechanical genius it can scarcely fail of securing satisfactory results. As in cases treated by any other method, care should be exercised for a considerable period after the removal of the splint not to bring the limb into too free use, for not rarely will the tendon itself lengthen after several weeks have elapsed, and what appeared to be a good result, months later makes a different exhibit. This is illustrated by the case of a physician in Cambridge, who remained in bed four months in order to be certain of a good result, but the tendon gradually lengthened for some months, until now it measures about two inches.















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